CLAIMS

What is claimed is:

1. A method for bonding tissue or sealing a fluid or gas leak in tissue comprising the steps of:
   (a) providing a protein, a surfactant, and a lipid in a liquid carrier;
   (b) providing a crosslinker capable of crosslinking the protein;
   (c) preparing a sealant by mixing the protein with the crosslinker under conditions which permit crosslinking of the protein; and
   (d) applying the sealant of (c) to a tissue, thereby to bond the tissue or seal a fluid or gas leak in the tissue.

2. A method for bonding tissue or sealing a fluid or gas leak in tissue comprising the steps of:
   (a) applying to a tissue locus:
      i. a protein preparation;
      ii. at least one preparation selected from the group consisting of a surfactant preparation and a lipid preparation; and
      iii. a crosslinker preparation; and
   (b) permitting the preparations to form crosslinks, thereby to bond said tissue or to seal a fluid or gas leak in said tissue.

3. The method of claim 1 or 2, wherein the protein is selected from the group consisting of albumin, collagen, gelatin, globulin, elastin, protamine, and histone.

4. The method of claim 3, wherein the concentration of the protein is between about 3% (w/w) and about 50% (w/w).

5. The method of claim 4, wherein the protein is albumin and wherein the concentration of albumin is between about 20% (w/w) and about 50% (w/w).

6. The method of claim 4, wherein the protein is collagen and wherein the concentration of collagen is between about 3% (w/w) and about 12% (w/w).

7. The method of claim 4, wherein the protein is a globulin and wherein the concentration of the globulin is betw en about 15% (w/w) and about 30% (w/w).

8. The method of claim 1 or 2, wherein the concentration of surfactant is between about 0.05% (w/w) and about 10% (w/w).

9. The method of claim 8, wherein the surfactant is an ionic surfactant.

10. The method of claim 9, wherein the ionic surfactant is selected from the group consisting of alkanoic acids, alkylsulfonic acids, alkyl amines, perfluoroalkanoic acids, and perfluoroalkylsulfonic acids.

11. The method of claim 10, wherein the ionic surfactant comprises an alkyl group with a chemical formula $CH_3(CH_2)_n$, wherein n is an integer from about 6 to about 18.

12. The method of claim 10, wherein the alkanoic acid is selected from the group consisting of octanoic acid, dodecanoic acid and palmitic acid.

13. The method of claim 10, wherein the alkylsulfonic acid is sodium lauryl sulfate.

14. The method of claim 10, wherein the perfluoroalkanoic acid has a structure selected from the group consisting of $CF_3(CF_2)_n$-COO-, and -OOC$(CF_2)_n$-COO-, wherein n is an integer from one to about sixteen.

15. The method of claim 10, wherein the perfluoroalkanoic acid is perfluorooctanoic acid.

16. The method of claim 1 or 2, wherein the surfactant is a nonionic surfactant.

17. The method of claim 16, wherein the nonionic surfactant is selected from the group consisting of an alkyl or perfluoroalkyl- polyoxyethylene ether, a polyoxyethylene ester, a polyoxyethylene sorbitan, and an alkyl aryl polyether alcohol.

18. The method of claim 17, wherein the alkyl aryl polyether alcohol is tyloxapol.

19. The method of claim 1 or 2, wherein the concentration of the lipid is from about 0.1% (w/v) to about 10% (w/v).

20. The method of claim 1 or 2, wherein the lipid is a naturally-occurring lipid.

21. The method of claim 1 or 2, wherein the lipid is a synthetic lipid.

22. The method of claim 1 or 2, wherein the lipid is a hydrophobically-modified glycerol derivative of a molecule selected from the group consisting of phosphocholines, phosphatidic acid, phosphatidylethanolamine, phosphatidyl inositol, glycerol, bile acids, and long chain alcohols.

23. The method of claim 22, wherein the hydrophobically-modified glycerol derivative of a phosphocholine has the structure R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-$OPO_2O(CH_2)_2$-$N(CH_3)_3$, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

24. The method of claim 22, wherein the hydrophobically-modified glycerol derivative of a phosphatidic acid has the structure R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-OPO_2H, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

25. The method of claim 22, wherein the hydrophobically-modified glycerol derivative of a phosphatidylethanolamine has the structure R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-OPO_2 $O(CH_2)_2$-NH_2, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

26. The method of claim 22, wherein the hydrophobically modified glycerol derivative of a phosphatidyl inositol has the structure of R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-OPO_2 $O(C_6)_2H_{11}O_5$, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

27. The method of claim 23-26, wherein the structure of R_1 is $CH_3(CH_2)_n$-, wherein the structure of R_2 is $CH_3(CH_2)_m$-, wherein n is an integer from about 4 to about 22, and wherein m is an integer from about 4 to about 22.

28. The method of claim 23, wherein the hydrophobically-modified glycerol derivative of a phosphocholine is dipalmitoylphosphatidyl choline.

29. The method of claim 22, wherein the bile acid is selected from the group consisting of cholic acid, chenodeoxycholic acid, cholic acid methyl ester, dehydrocholic acid, deoxycholic acid, and lithocholic acid.

30. The method of claim 22, wherein the long chain alcohol has the structure $CH_3(CH_2)_n$-OH, wherein n is an integer from about six to about twenty-two.

31. The method of claim 1 or 2, wherein the crosslinker is a zero-length, homobifunctional, heterobifunctional, or multifunctional crosslinker.

32. The method of claim 31, wherein the zero-length crosslinker is selected from the group consisting of carbodiimides, isoxazolium salts, and carbonyldiimidazole

33. The method of claim 31, wherein the carbodiimide is 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride (EDC)

34. The method of claim 32, wherein the concentration of EDC is from about 5 to about 500 mg/mL.

35. The method of claim 31, wherein the zerolength crosslinker is selected from the group consisting of a carbodiimide mediated reactive ester and a carbamate.

36. The method of claim 35, wherein the reactive ester is formed from N-hydroxysuccinimide or N-hydroxysulfosuccinimide.

37. The method of claim 1 or 2, wherein the surfactant is covalently attached to the protein.

38. The method of claim 1 or 2, wherein the surfactant is not covalently attached to the protein.

39. The method of claim 1 or 2, wherein the lipid is covalently attached to the protein.

40. The method of claim 1 or 2, wherein the lipid is not covalently attached to the protein.

41. A kit for producing a protein-based tissue adhesive or sealant comprising:

(a) a protein preparation;

(b) a protein-degrading preparation; and

(c) a crosslinker preparation.

42. A kit for producing a protein-based tissue adhesive or sealant comprising:

(a) a protein preparation;

(b) a crosslinker preparation; and

(c) at least one preparation selected from the group consisting of a surfactant preparation and a lipid preparation.

43. The kit of claim 42 further comprising at least one preparation selected from the group consisting of a tissue primer preparation and a protein-degrading preparation.

44. The kit of claim 41 or 42, wherein the protein is selected from the group consisting of albumin, collagen, gelatin, globulin, elastin, protamine, and histone.

45. The kit of claim 44, wherein the concentration of the protein is between about 3% (w/w) and about 50% (w/w).

46. The kit of claim 45, wherein the protein is albumin and wherein the concentration of albumin is between about 25% (w/w) and about 50% (w/w)

47. The kit of claim 45, wherein the protein is collagen and wherein the concentration of collagen is between about 3% (w/w) and about 12% (w/w).

48. The kit of claim 45, wherein the protein is a globulin and wherein the concentration of the globulin is between about 15% (w/w) and about 30% (w/w).

49. The kit of claim 42, wherein the concentration of surfactant is between about 0.05% (w/w) and about 10% (w/w).

50. The kit of claim 42, wherein the surfactant is an ionic surfactant.

51. The kit of claim 50, wherein the ionic surfactant is selected from the group consisting of alkanoic acids, alkylsulfonic acids, alkyl amines, perfluoroalkanoic acids, and perfluoroalkylsulfonic acids.

52. The kit of claim 50, wherein the ionic surfactant comprises an alkyl group with a chemical formula $CH_3(CH_2)_n$, wherein n is an integer from about 6 to about 18.

53. The kit of claim 51, wherein the alkanoic acid is selected from the group consisting of octanoic acid, dodecanoic acid and palmitic acid.

54. The kit of claim 51, wherein the alkylsulfonic acid is sodium lauryl sulfate.

55. The kit of claim 51, wherein the perfluoroalkanoic acid has a structure selected from the group consisting of $CF_3(CF_2)_n$-COO-, and -OOC$(CF_2)_n$-COO-, wherein n is an integer from one to about sixteen.

56. The kit of claim 51, wherein the perfluoroalkanoic acid is perfluorooctanoic acid.

57. The kit of claim 42, wherein the surfactant is a nonionic surfactant.

58. The kit of claim 57, wherein the nonionic surfactant is selected from the group consisting of an alkyl or perfluoroalkyl- polyoxyethylene ether, a polyoxyethylene ester, a polyoxyethylene sorbitan, and an alkyl aryl polyether alcohol.

59. The kit of claim 57, wherein the alkyl aryl polyether alcohol is tyloxapol.

60. The kit of claim 42, wherein the concentration of the lipid is from about 0.1% (w/v) to about 10% (w/v).

61. The kit of claim 42, wherein the lipid is a naturally-occurring lipid.

62. The kit of claim 42, wherein the lipid is a synthetic lipid.

63. The kit of claim 42, wherein the lipid is a hydrophobically-modified glycerol derivative of a molecule selected from the group consisting of phosphocholines, phosphatidic acid, phosphatidylethanolamine, phosphatidyl inositol, glycerol, bile acids, and long chain alcohols.

64. The kit of claim 63, wherein the hydrophobically-modified glycerol derivative of a phosphocholine has the structure R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-$OPO_2O(CH_2)_2$-$N(CH_3)_3$, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

65. The kit of claim 63, wherein the hydrophobically-modified glycerol derivative of a phosphatidic acid has the structure R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-OPO_2H, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

66. The kit of claim 63, wherein the hydrophobically-modified glycerol derivative of a phosphatidylethanolamine has the structure R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-OPO_2 $O(CH_2)_2$-NH_2, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

67. The kit of claim 63, wherein the hydrophobically modified glycerol derivative of a phosphatidyl inositol has the structure of R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-OPO_2 $O(C_6)_2H_{11}O_5$, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

68. The kit of claim 64-67, wherein the structure of R_1 is $CH_3(CH_2)_n$-, wherein the structure of R_2 is $CH_3(CH_2)_m$-, wherein n is an integer from about 4 to about 22, and wherein m is an integer from about 4 to about 22.

69. The kit of claim 64, wherein the hydrophobically-modified glycerol derivative of a phosphocholine is dipalmitoylphosphatidyl choline.

70. The kit of claim 63, wherein the bile acid is selected from the group consisting of cholic acid, chenodeoxycholic acid, cholic acid methyl ester, dehydrocholic acid, deoxycholic acid, and lithocholic acid.

71. The kit of claim 63, wherein the long chain alcohol has the structure $CH_3(CH_2)_n$-OH, wherein n is an integer from about six to about twenty-two.

72. The kit of claim 41 or 42, wherein the crosslinker is a zero-length, homobifunctional, heterobifunctional, or multifunctional crosslinker.

73. The kit of claim 72, wherein the zero-length crosslinker is selected from the group consisting of carbodiimides, isoxazolium salts, and carbonyldiimidazole.

74. The kit of claim 73, wherein the carbodiimide is 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride (EDC).

75. The kit of claim 74, wherein the concentration of EDC is from about 5 to about 500 mg/mL.

76. The kit of claim 72, wherein the zero-length crosslinker is selected from the group consisting of a carbodiimide mediated reactive ester and a carbamate.

77. The kit of claim 76, wherein the reactive ester is formed from N-hydroxysuccinimide or N-hydroxysulfosuccinimide.

78. The kit of claim 42, wherein the surfactant is covalently attached to the protein.

79. The kit of claim 42, wherein the surfactant is not covalently attached to the protein.

80. The kit of claim 42, wherein the lipid is covalently attached to the protein.

81. The kit of claim 42, wherein the lipid is not covalently attached to the protein.

82. A platelet-free composition for use as a tissue sealant or adhesive comprising a protein solution and at least one preparation selected from the group consisting of a surfactant preparation and a lipid preparation.

83. The composition of claim 82 comprising a protein solution, a surfactant preparation and a lipid preparation.

84. The composition of claim 82, wherein the protein is selected from the group consisting of albumin, collagen, gelatin, globulin, elastin, protamine, and histone.

85. The composition of claim 84, wherein the concentration of the protein is between about 3% (w/w) and 50% (w/w).

86. The composition of claim 85, wherein the protein is albumin and wherein the concentration of albumin is between about 25% (w/w) and about 50% (w/w)

87. The composition of claim 85, wherein the protein is collagen and wherein the concentration of collagen is between about 3% (w/w) and about 12% (w/w).

88. The composition of claim 85, wherein the protein is a globulin and wherein the concentration of the globulin is between about 15% (w/w) and about 30% (w/w).

89. The composition of claim 82, wherein the concentration of surfactant is between about 0.05% (w/w) and about 10% (w/w).

90. The composition of claim 82, wherein the surfactant is an ionic surfactant.

91. The composition of claim 90, wherein the ionic surfactant is selected from the group consisting of alkanoic acids, alkylsulfonic acids, alkyl amines, perfluoroalkanoic acids, and perfluoroalkylsulfonic acids.

92. The composition of claim 91, wherein the ionic surfactant comprises an alkyl group with a chemical formula $CH_3(CH_2)_n$, wherein n is an integer from about 6 to about 18.

93. The composition of claim 91, wherein the alkanoic acid is selected from the group consisting of octanoic acid, dodecanoic acid and palmitic acid.

94. The composition of claim 91, wherein the alkylsulfonic acid is sodium lauryl sulfate.

95. The composition of claim 91, wherein the perfluoroalkanoic acid has a structure selected from the group consisting of $CF_3(CF_2)_n$-COO-, and -OOC$(CF_2)_n$-COO-, wherein n is an integer from one to about sixteen.

96. The composition of claim 91, wherein the perfluoroalkanoic acid is perfluorooctanoic acid.

97. The composition of claim 82, wherein the surfactant is a nonionic surfactant.

98. The composition of claim 97, wherein the nonionic surfactant is selected from the group consisting of an alkyl or perfluoroalkyl- polyoxyethylene ether, a polyoxyethylene ester, a polyoxyethylene sorbitan, and an alkyl aryl polyether alcohol.

99. The composition of claim 98, wherein the alkyl aryl polyether alcohol is tyloxapol.

100. The composition of claim 82, wherein the concentration of the lipid is from about 0.1% (w/v) to about 10% (w/v).

101. The composition of claim 82, wherein the lipid is a naturally-occurring lipid.

102. The composition of claim 82, wherein the lipid is a synthetic lipid.

103. The composition of claim 82, wherein the lipid is a hydrophobically-modified glycerol derivative of a molecule selected from the group consisting of phosphocholines, phosphatidic acid, phosphatidylethanolamine, phosphatidyl inositol, glycerol, bile acids, and long chain alcohols.

104. The composition of claim 103, wherein the hydrophobically-modified glycerol derivative of a phosphocholine has the structure R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-OPO_2O$(CH_2)_2$-N$(CH_3)_3$, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

105. The composition of claim 103, wherein the hydrophobically-modified glycerol derivative of a phosphatidic acid has the structure R_1-C(O)-O-CH_2-(R_2-C(O)-

O)CH_2-CH_2-OPO_2H, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

106. The composition of claim 103, wherein the hydrophobically-modified glycerol derivative of a phosphatidylethanolamine has the structure R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-OPO_2 $O(CH_2)_2$-NH_2, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

107. The composition of claim 103, wherein the hydrophobically modified glycerol derivative of a phosphatidyl inositol has the structure of R_1-C(O)-O-CH_2-(R_2-C(O)-O)CH_2-CH_2-OPO_2 $O(C_6)_2H_{11}O_5$, wherein R_1 and R_2 are chemical groups that do not react with a carbodiimide.

108. The composition of claim 104-107, wherein the structure of R_1 is $CH_3(CH_2)_n$-, wherein the structure of R_2 is $CH_3(CH_2)_m$-, wherein n is an integer from about 4 to about 22, and wherein m is an integer from about 4 to about 22.

109. The composition of claim 104, wherein the hydrophobically-modified glycerol derivative of a phosphocholine is dipalmitoylphosphatidyl choline.

110. The composition of claim 103, wherein the bile acid is selected from the group consisting of cholic acid, chenodeoxycholic acid, cholic acid methyl ester, dehydrocholic acid, deoxycholic acid, and lithocholic acid.

111. The composition of claim 103, wherein the long chain alcohol has the structure $CH_3(CH_2)_n$-OH, wherein n is an integer from about six to about twenty-two.

112. The composition of claim 82, wherein the surfactant is covalently attached to the protein.

113. The composition of claim 82, wherein the surfactant is not covalently attached to the protein.

114. The composition of claim 82, wherein the lipid is covalently attached to the protein.

115. The composition of claim 82, wherein the lipid is not covalently attached to the protein.

116. A method for preparing a tissue to react with a protein-based tissue sealant or adhesive comprising the step of:

applying a primer solution at a pH of about 3.0 to 9.0 to a tissue locus.

117. The method of claim 116, wherein the primer solution comprises a buffer.

118. The method of claim 117, wherein the buffer is morpholinoethanesulfonic acid.

119. The method of claim 118, wherein the pH is about 5.

120. The method of claim 118, wherein the concentration of the buffer is about 0.5M.

121. A method for preparing a tissue to react with a protein-based tissue sealant or adhesive comprising the step of:

applying a primer solution containing a protein crosslinker to a tissue locus.

122. The method of claim 121, wherein the crosslinker is carbodiimide.

123. The method of claim 122, wherein the carbodiimide is EDC-HCl.

124. The method of claim 121, wherein the primer is a solution of carbodiimide and hydroxysuccinimide.

125. The method of claim 124, wherein the carbodiimide is EDC-HCl and the hydroxysuccinimide is N-hydroxysulfosuccinimide.

126. The method of claim 121, wherein the primer is a solution of a dialdehyde or a polyaldehyde.

127. The method of claim 126, wherein the primer comprises glutaraldehyde or a derivative thereof.

128. A method for preparing a tissue to react with a protein-based tissue sealant or adhesive comprising the step of:

applying a primer solution comprising a molecule that promotes contact between the sealant and a tissue, thereby promoting an increase in reactive surface area between the sealant and the tissue.

129. The method of claim 128, wherein the molecule interacts preferentially with fluorophilic surfaces.

130. The method of claim 128, wherein the molecule comprises a fluorophilic moiety.

131. The method of claim 130, wherein the fluorophilic moiety is a perfluoroalkanoic acid.

132. The method of claim 131, wherein the perfluoroalkanoic acid is perfluorooctanoic acid.

133. A method for increasing the degradation rate, or reducing the persistence of a polymer-based tissue sealant or adhesive, comprising the step of:

mixing a polymer degrading agent with a sealant or adhesive before applying the sealant or adhesive to a tissue.

134. A method for increasing the degradation rate, or reducing the persistence of a polymer-based tissue sealant or adhesive, comprising the step of:

applying a polymer degrading agent to a sealant or adhesive at a tissue locus, thereby increasing the degradation rate of the sealant or adhesive at the tissue.

135. The method of claim 133 or 134, wherein the sealant or adhesive is selected from the group consisting of protein-based, carbohydrate-based, nucleotide-based, and synthetic polymer-based tissue sealants or adhesives or any combination thereof.

136. The method of claim 133, wherein said tissue sealant or adhesive is protein-based.

137. The method of claim 136, wherein the protein is selected from the group consisting of albumin, collagen, and globulin.

138. The method of claim 133 or 134, wherein the sealant or adhesive is carbohydrate-based.

139. The method of claim 138, wherein the carbohydrate is selected from the group consisting of natural and synthetic poly- and oligo-saccharides.

140. The method of claim 139, wherein the carbohydrate is selected from the group consisting of amylose, amylopectin, alginate, agarose, cellulose,

carboxymethylcellulose, carboxymethylamylose, chitin, chitosan, pectin, and dextran.

141. The method of claim 133 or 134, wherein the degradation agent is an enzyme.

142. The method of claim 141, wherein the enzyme is selected from the group consisting of proteases and glucanases.

143. The method of claim 142, wherein the protease is selected from the group consisting of bromelain, trypsin, chymotrypsin, clostripain, collagenase, elastase, papain, proteinase K, pepsin, and subtilisin.

144. The method of claim 143, wherein the protease is trypsin.

145. The method of claim 142, wherein the glucanase is selected from the group consisting of agarases, amylases, cellulases, chitinases, dextranases, hyaluranidases, lysozymes, and pectinases.

146. The method of claim 145, wherein the glucanase is cellulase.

147. The method of claim 133 or 134, wherein the degradation agent is provided in an amount sufficient to promote degradation of the tissue sealant or adhesive within forty days.

148. The method of claim 133 or 134, wherein the degradation agent is provided in an inactive form, and wherein the degradation agent is activated after its application to the sealant or adhesive.

149. The method of claim 133 or 134, wherein the tissue is selected from the group consisting of connective tissue, vascular tissue, pulmonary tissue, neural tissue, lymphatic tissue, dural tissue, spleen tissue, hepatic tissue, renal tissue, gastrointestinal tissue, and skin.

150. A method for bonding tissue or sealing a fluid or gas leak in tissue comprising the steps of:

(a) providing a solution comprising about 35% BSA, 5% DPPC, and 5% Tyloxapol;

(b) providing a solution of about 200 mg/ml EDC;

(c) preparing a sealant by mixing the solution of step (a) with the solution of step (b) in a ratio of about 10/1 (v/v); and

(d) applying the sealant of step (c) to a tissue, thereby to bond the tissue or seal a fluid or gas leak in the tissue.

151. A kit for producing a protein-based tissue adhesive or sealant comprising:

(a) a solution comprising about 35% BSA;

(b) a crosslinker preparation comprising about 20% EDC; and

(c) at least one preparation selected from the group consisting of about 5% DPPC, about 5% Tyloxapol, and a combination thereof.

152. A two- component kit for producing a protein-based tissue adhesive or sealant comprising:

(a) a first protein preparation; and,

(b) a second protein preparation mixed with a cross-linker preparation.

153. The kit of claim 152, wherein said first protein preparation is at an acid pH and said second protein preparation is at a basic pH.

154. A two-component kit for producing a tissue adhesive or sealant comprising:

(a) a first sealant component at an acid pH;

(b) a second sealant component at a basic pH; and,

(c) a cross-linker preparation that is active at an intermediate pH,

wherein the cross-linker is activated upon mixing of (a), (b), and (c).

155. The kit of claim 153, wherein the pH of said first protein preparation is between about 3.0 and 6.0.

156. The kit of claim 153, wherein the pH of said second protein preparation is between about 6.5 and 10.0.

157. The kit of claim 152, wherein said first protein preparation and said second protein preparation are selected from the group consisting of albumin, collagen, gelatin, globulins, protamine, and histones.

158. The kit of claim 157, wherein said first protein preparation and said second protein preparation comprise between about 3% (w/w) and about 50%(w/w) of protein.

159. The kit of claim 157, wherein said first protein preparation and said second protein preparation comprise albumin at between about 15% (w/w) and about 50%(w/w).

160. A kit for producing a protein-based tissue adhesive or sealant comprising:
(a) a preparation comprising a protein and a carbohydrate;
(b) a degradation agent; and,
(c) a cross-linker preparation.

161. The kit of claim 160, wherein said protein is selected from the the group consisting of albumin, collagen, gelatin, globulins, protamine, and histones.

162. The kit of claim 160, wherein said protein is at a concentration of between about 15% and about 40%.

163. The kit of claim 160, wherein said carbohydrate is selected from the group consisting of natural and synthetic poly- and oligo-saccharides.

164. The kit of claim 160, wherein said carbohydrate is selected from the group consisting of of amylose, amylopectin, alginate, agarose, cellulose, carboxymethylcellulose, carboxymethylamylose, chitin, chitosan, pectin, and dextran.

165. The kit of claim 160, wherein said carbohydrate is at a concentration of between about about 0.1% (w/w) and about 10% (w/w).

166. The kit of claim 160, wherein said degradation agent is selected from the group consisting of proteases and glucanases.

167. The kit of claim 166, wherein said glucanases is an alginase.